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THESIS

ESTABLISHING A CHARGEBACK POLICY:
WHAT THE DEPARTMENT OF DEFENSE CAN LEARN
FROM ONE COMPANY'S APPROACH

by

Jill E. Fisher

December, 1993

Thesis Advisor:

William R. Gates

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ESTABLISHING A CHARGEBACK POLICY:
WHAT THE DEPARTMENT OF DEFENSE CAN LEARN
FROM ONE COMPANY'S APPROACH

by

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Submitted in partial fulfillment
of the requirements for the degree of

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from the

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ABSTRACT

A large California-based computer and electronics manufacturer is currently consolidating its Information Technology Centers. This thesis addresses the problems the company is experiencing with implementing the consolidation and developing the chargeback scheme which will be used. The Department of Defense (DOD) is currently consolidating its own data processing centers and instituting a fee-for-service (chargeback/cost recovery) policy. This thesis will highlight some of the problems DOD may encounter in instituting its own cost recovery policies and other major organizational change.

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I. INTRODUCTION

A. PURPOSE

This thesis' objective is to analyze the chargeback decisions made by a large California-based computer and electronics manufacturer which has recently decided to consolidate its Information Technology (IT) services. This analysis is being done in an effort to derive lessons learned from which the Department of Defense (DOD) can benefit. At the company's request, both the company's name and descriptive details have been changed to ensure confidentiality.

DOD is currently implementing its own IT center consolidation. Defense Management Review Decision (DRMD) 918 has directed the Department of Defense to consolidate the military services' data processing centers and software design activities under the Defense Information System Agency (DISA). When the consolidation is complete, DISA will provide Information Technology (IT) services to the military on a fee-for-service (chargeback) basis. (Endoso, 1992, p.6) The analysis which follows will highlight some of the problems which DOD may encounter in instituting its own fee-for-service policy.

B. METHODOLOGY AND RESEARCH QUESTIONS

Background information for this analysis was gathered using three methods:

- Two site visits
- Several telephone interviews with key company personnel
- A review of the literature pertaining to the company and its philosophy

The purpose of the first site visit was to conduct a semi-structured interview with the company's Corporate Network Services to learn more about the organization and determine whether a valid research opportunity existed. The second site visit involved an extensive semi-structured/open-ended interview with the company's Internal Change Consultant. This interview focused on the data center consolidation which is the subject of this thesis. The Internal Change Consultant discussed the details of the consolidation, the difficulties the company was encountering, and the steps the company was taking to facilitate the change. The Consultant also provided a confidential company "whitepaper" concerning the consolidation. A secondary focus of this interview was the company's corporate culture. The Consultant described the company's approach to doing business and conducted a tour of the headquarters building.

The telephone interviews were conducted following the site visits. The Corporate Network Services Manager and the Internal Change Consultant were interviewed for the purpose of clarifying the information conveyed in the face-to-face interviews discussed above. Additionally, the Corporate Information Services Comptroller was interviewed extensively concerning the company's efforts to establish its chargeback policy. These semi-structured/open-ended interviews consisted of questions concerning the process by which the chargeback policy was being established, the company's chargeback objectives, and the chargeback decisions the company had already made.

The study is designed to answer the following research questions:

- What difficulties is the company encountering in its consolidation efforts?
- What objectives does the company hope to accomplish with its chargeback policy?
- What chargeback methods does the industry currently use?
- What objectives do these methods accomplish?
- How have other organizations solved their own chargeback dilemmas?
- Which of the company's chargeback policy objectives are accomplished by the current chargeback methods?
- Are there aspects of change management theory which might help the company overcome the difficulties it is encountering with its consolidation?
- What can DOD learn from the company's experience?

C. ORGANIZATION OF STUDY

This chapter describes the thesis' purpose, its relevance to DOD, and the research questions which will be addressed. Chapter II discusses data processing chargeback and the objectives it can accomplish. Chapter III describes and lists the advantages and disadvantages of the basic chargeback methods currently in use. Chapter IV outlines the transition the company is undergoing, the resistance it is encountering, efforts to overcome the resistance, and some of the current thinking on managing change. Chapter V focuses on the company's effort to establish its chargeback policy. Chapter VI describes the chargeback policies adopted by other organizations. Chapter VII analyzes the chargeback approach taken by the subject company. Chapter VIII concludes the thesis, discusses its relevance to DOD, and suggests areas for further study.

II. DATA PROCESSING CHARGEBACK

A. INTRODUCTION

A data processing chargeback system:

accounts for who uses a company's computer resources and allocates the cost back to those users. Such a system calculates billing rates and monitors the use of IS services. It also reports to or bills customers according to their utilization or work volume (Butler, 1992, p.48).

This chapter first analyzes the purposes that a chargeback system can serve within an organization. Then it discusses several criteria by which a chargeback system's effectiveness can be judged.

B. MANAGEMENT CONTROL

Data processing chargeback is intended to accomplish management control. Management control is "the process by which managers influence other members of the organization to implement the organization's strategies." (Anthony, 1988, p.10) The control process consists of four steps. (Anthony, 1988, p.8):

1. The organization sets its performance standards.
2. The organization establishes a mechanism for performing status checks (with respect to the standard) and communicating them to a control unit.
3. The control unit compares the status with the standard (i.e., the reality with the goal).
4. If the standard and the status are different, corrective action is directed and taken.

When data processing chargeback is instituted, the "standard" is usually the data processing budget and the mechanism for performing the status checks is the pricing strategy employed. Data processing chargeback uses both budget and pricing in an attempt to control resource use in the short-run and provide information to make resource decisions in the long-run. This thesis discusses alternative pricing strategies. To complete the management control discussion, this thesis should be augmented by a budget determination and a management control analysis.

C. WHY ORGANIZATIONS CHARGE FOR DATA PROCESSING RESOURCE USE

The first question which must be addressed in any discussion of data processing chargeback techniques is "Why charge users at all? Why not treat data processing expenses as corporate overhead and accumulate them in the same account as electricity and rent?"

The primary reason most large organizations charge users for data processing resources is:

... without some effective means of control, computing resources have a particularly strong tendency to be used ineffectively, while demand seems capable of growing without apparent limit. (Bernard, 1977, p.2)

In addition to controlling data processing resource use, a well-designed chargeback system can serve several other purposes.

D. WHAT CHARGEBACK CAN DO FOR AN ORGANIZATION

1. Recover Costs

Chargeback can accomplish cost recovery (Hill, 1979, p.13). If an organization invests \$200,000 in data processing resources, it can charge its users \$200,000 to recover its costs.

2. Encourage User Cost Consciousness

Users required to pay for data processing service typically evaluate their usage choices carefully (Sanders, 1986, p.42-45). Being charged \$100.00 for using a resource forces the user to consider whether he/she is receiving \$100.00 worth of benefit from the resource's use. Performing this cost/benefit analysis prior to every usage decision transforms the user into an informed buyer, and also exerts pressure on the data processing supplier to provide a quality product.

3. Efficiently Allocate Resources

Ideally, a well-designed chargeback system can achieve effective and efficient allocation of scarce data

processing resources (Lin 1983, p.9). This can be accomplished by using a pricing structure which regulates demand and ensures that users who value the resource the most are able to obtain it in sufficient quantity.

4. Communicate Management Policy

In addition to ensuring both sufficient quality and quantity, an organization's chargeback policy can communicate management's goals and priorities to employees. Suppose, for example, management wants employees to automate divisional accounting functions. One way to encourage this is to install accounting application software on the central computer and allow free access for the first six months.

5. Achieve Organizational-individual Goal Congruence

The chargeback policy, in the above case free-usage for an accounting application, could modify users' behavior in a manner beneficial to the company as a whole. Thus an effective chargeback system can accomplish organizational-individual goal congruence, an ideal situation in which decisions made to maximize the profits of individual divisions also maximize the profit of the firm as a whole. (Eccles, p. 27)

6. Communicate User Needs

In addition to achieving this congruence, a chargeback system can maintain and nurture a valuable connection between upper-level management and the end users. In many large organizations, data processing services are

managed from the corporate offices, at a level far removed from the individuals who use the system. When end users are both required to pay for the services and involved in the process which establishes the prices, their data processing needs are made known to management. The result is a corporate information service which satisfies the requirements of both upper management and end-users.

7. Provide Capacity Planning Information

An effective chargeback system also allows upper management to do capacity planning (Sanders, 1986, p.42). If the usage levels tracked by the chargeback system indicate that demand exceeds supply, management can use this information to justify additional equipment or additional staff. The data gathered by the chargeback system enables management to perform trend analyses and express the rationale behind their decision in dollars and cents.

E. CRITERIA FOR AN EFFECTIVE CHARGEBACK SYSTEM

A poorly conceived chargeback scheme can adversely affect the organization which uses it (Hufnagel, Birnberg, 1989, p. 415). It can increase conflict among divisions, decrease employees' motivation to control data processing costs, and make expenditure planning impossible. Thompson states:

The fact that such accounting and statistical schemes are socially invented and validated means that they are more vulnerable to attack than are empirical referents, and leads to some important consequences for the behavior of individuals and groups within the organization (1967, p 5).

The literature emphasizes several criteria which a chargeback scheme must satisfy to avoid dysfunctional consequences within an organization.

1. Equitable (Hufnagel, Birnberg 1989)

A chargeback system must appear fair to those affected by it. If the system appears to benefit one group at the expense of another, conflict between the two groups is inevitable. Fairness, though, is not an easy idea to operationalize. It is subjective and "context-dependent" (Hufnagel, Birnberg, 1989, p.423). What may seem fair to one group may seem grossly unjust to another. An organization's goal, then, must be to establish a chargeback policy which appears fair to as many personnel as possible - particularly in the areas of pricing (prices should not exceed market prices) and exchange autonomy (freedom to buy services outside the organization). Perceived fairness can be accomplished by including end-users in the process which determines the organization's chargeback policy.

2. Understandable (Drury, 1982, pp.31-36)

Users must receive usage reports which are itemized in terms they can understand. In reality, this is rarely the case. The typical usage report is itemized at a "level of

accounting (or data processing) sophistication that confounds its recipients" (Drury, 1982, p.32). This occurs because the personnel typically responsible for creating the chargeback scheme are accountants and data processors.

A user who cannot understand a usage report cannot modify his usage behavior. An incomprehensible report thus prevents chargeback from accomplishing its primary objective: modifying user behavior in support of organizational goals.

Most of the current literature recommends against using complex billing algorithms such as the one depicted in Figure 1. Instead, the recommendation is to use a natural billing unit (Alley, Willits, 1985). Examples of natural billing units are "number of invoices processed," "number of reports printed," "number of database queries processed," or "programmer manhours used." The billing unit used must be meaningful to the organization being billed. For example, a department which processes orders should be billed for "orders processed." The advantage to basing a chargeback scheme on natural billing units is that users can see a relationship between what they use and what they pay.

3. Controllable (Hufnagel, Birnberg, 1989, p. 423)

Users must be able to control their data processing charges. They should participate in the process which determines the chargeback policy and they should be charged only for data processing activities within their control.

**4. Accurate, timely, flexible, realistic, and auditable
(Schechinger, Prack, 1983, p.48-50)**

The chargeback system should be based on accurate accounts of usage, the user should be billed regularly, and the chargeback policy should be flexible enough (but not fluctuate dramatically) to meet changing business needs. The charges should be realistic (i.e., reasonably close to market price) and auditable by outside agencies.

5. Inexpensive to Administer and Maintain

As will become obvious in the chapter which follows, there is often a tradeoff between efficiency in data processing resource use and the expense inherent in administering a chargeback system. Chargeback methods which promote efficient resource use (i.e., flexible pricing) are the most expensive for an organization to administer, while those which do not promote efficient resource use (i.e., free allocation) cost little.

$$AC = \left[\sum_{j=1}^k AF_j \left(\sum_{i=1}^n U_{ij} * UCI_i \right) \right] + (TD * UCF)$$

AC = Account Charge

k = Total Jobs Run using Computer Resources

AFJ = Run Category Adjustment Factor

n = Total resources used for a job

Uij = Utilization of resources i by job j

UCI = Unit Charge Rate for Resource i

TD = File Space Assigned to the Account in Track Days

UCF = Unit Charge for File Space

Figure 1: Navy Regional Data Center Billing Algorithm
(Potter, 1986, p.46)

III. CHARGEBACK METHODS

A. INTRODUCTION

There are many different methods by which chargeback can be accomplished. A review of the current chargeback literature reveals three chargeback techniques frequently used for computer time: free allocation (no charge), direct allocation (using "funny money"), and direct chargeback (using "hard money"). This chapter describes each method and discusses its advantages and disadvantages. Figure 2 will aid in understanding the discussion which follows.

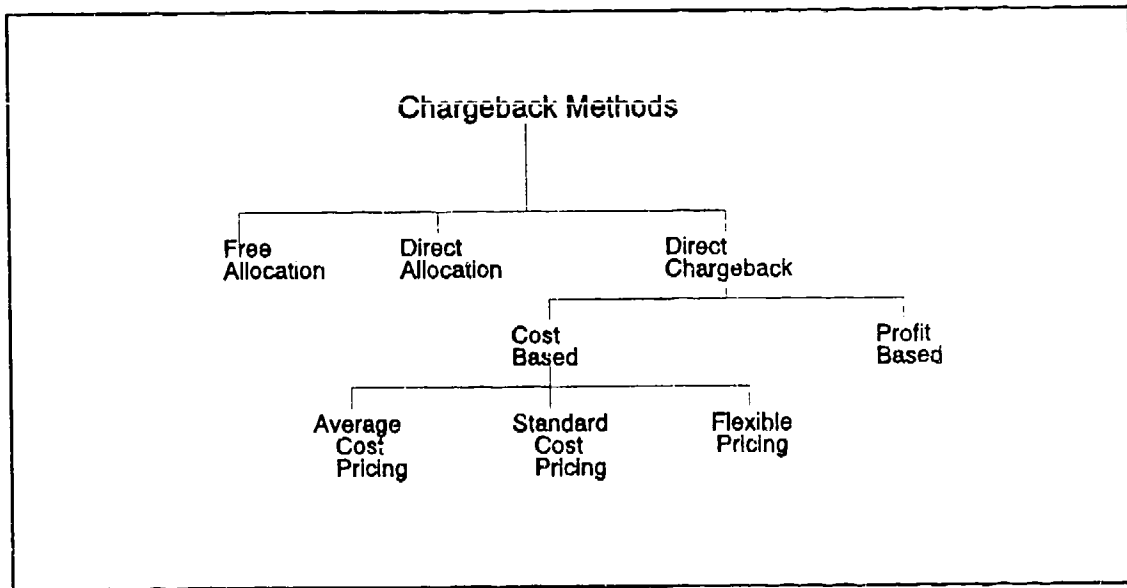


Figure 2. Chargeback Methods (Lin, 1983, p.6)

B. CHARGEBACK METHODS

1. Free Allocation (Potter, 1986, p.33)

Some organizations resolve their chargeback dilemma by not charging for computer resource use; computer resources are treated instead as free goods. Computer users consume as much of the data processing resource as their circumstances require; the organization assigns the costs to its own overhead accounts and "foots" the bill.

There are many obvious disadvantages to not charging for computer resources. If users are not required to pay, they have no incentive to make cost effective decisions concerning which applications or jobs to run. Their inclination is to run everything. This would have several adverse effects. For example, the users' high accumulated demand may create resource-use congestion which would reduce the computer's response time. It is possible too that users who value their jobs most highly may not get their jobs through. When jobs are not priced, there is no way for the computer to determine which jobs have the highest priority. Even if the data service center requires users to assign priorities to their jobs, there is no incentive for users to reveal their true priorities unless they are required to pay more for jobs with a higher priority.

Not charging for computer use has another drawback. It eliminates one of the primary reasons that computer

programmers write efficient code - to save computer time and hence money. If computer time costs nothing, why should any effort be made to conserve its use?

Finally, management has no method of determining exactly their organization's data processing needs. When computer time is a free good, users are motivated to use all available capacity regardless of the value of their service.

There is, however, one strong advantage an organization realizes when it treats data processing as a free good: the organization encourages computer use (Sanders, 1986, p.43). Many organizations, having recently acquired a central computer, choose not to charge for computer time for this reason. During what Nolan (1979, pp.115-126) terms the initiation stage of data processing technology use, automation is introduced to an organization. Success during this phase requires that the technology find valuable uses. Users are more likely to identify valuable uses (i.e. functions which should be automated) when they are not charged for automated data processing use.

Two additional advantages to free allocation are that it is equitable (i.e., all users are affected equally) and simple. This simplicity makes it easy to understand and inexpensive to administer (Hill, 1979, p13). As will become obvious, many chargeback techniques result in more efficient resource use. This benefit, however, must be weighed against the overhead cost required to administer them.

2. Allocation (Lin, 1983, p.7)

The allocation chargeback method treats the computer resource as one of the organization's overhead expenses. Management or a computer steering committee decides how much money the organization will spend on data processing during a given time period. This amount is allocated to divisions within the organization. Each division is typically granted "funny money" equal to the cost of their share of the computer resource. This money can be spent only as "payment" for the data processing resource they use.

The allocation method has many of the same advantages as the free good approach. It encourages use of the computer (at least up to the amount allocated) and it is predictable, understandable and easy to administer.

Allocation shares many of free good's disadvantages as well. Under allocation, there is little incentive to make trade-off decisions across users. Users simply consume up to the amount allocated and stop. This has the potential to create inefficiencies because users may have very different values for the least valued jobs processed. (The least valued jobs processed are those jobs for which the users' marginal value equals his marginal cost.) The overall value of the central computer could have been increased by shifting resources to the user with the highest incremental value. Unfortunately, with allocation it is difficult for management

to get accurate information regarding the relative value across users, unless the funny money is exchanged across divisions for other resources with quantifiable values.

Allocation can have a second dysfunctional consequence. If users are not allocate the amount of computer time they need, a black market "barter" system may be established to accomplish redistribution. As an example, suppose user A needs \$100.00 worth of computer time but has only been allocated \$80.00. User B, on the other hand, needs only \$60.00 worth of computer time, but has been allocated \$80.00. User A can offer user B something (i.e., a good or a service) in exchange for user B's excess \$20.00 of computer time. The time users expend in finding each other and establishing this transaction is a real cost to the organization.

3. Direct Chargeback (Lin, 1983, pp.7-10)

By far the most common method of charging users for data processing services is direct chargeback. With direct chargeback, each using department has its own operating budget, and, within the constraints of this budget, spends its own money on data processing resources. For example, if department A has \$500,000 to spend in fiscal year 1993, it can spend \$200,000 on data processing resources, \$200,000 on executive and clerical salaries and \$100,000 on the Christmas party and coffee.

Direct chargeback employs the "hard money" concept (McKinnon, Kallman, 1987, p.7). Unlike "funny money" used with the allocation chargeback method, "hard money" can be spent for any resources the department needs to perform its function. This forces the department to make trade-off decisions concerning the allocation of its scarce budgetary resources (i.e., "we need more data processing this year, so I guess that means less coffee"). When all departments are required to make these decisions, it can result in optimal resource use throughout the organization, depending upon how prices are determined. The primary difference between the following direct chargeback schemes is the means by which prices are assigned to the computer resource.

a. Profit-based Pricing (Anthony, 1988, Eccles, 1985, Lin 1983)

With profit-based pricing, computer resource prices are based upon the price the resources currently command on the open market. Each department within the organization is operated as an individual profit-center. A profit-center is a "responsibility center whose performance is measured as the difference between its revenues and its expenses or costs." (Anthony, 1988, p.64) The profit-center concept is most commonly employed in highly decentralized organizations

composed of departments or divisions responsible for manufacturing and marketing a single product line.

Organizations usually choose to operate individual divisions as profit-centers with one end in mind: they hope to motivate divisional managers to run the divisions as though they were their own small businesses. If there are no interdepartmental dependencies, this arrangement can create organizational-divisional goal congruence - an ideal situation in which decisions made at the divisional level are optimal for the firm as a whole. (Anthony, 1988, p.24) If, for example, a division manager's goal is to achieve a profit for his division, the manager will work to increase revenue and minimize costs. One way to accomplish both is to make efficient use of the organization's data processing services. If every divisional manager makes efficient usage decisions, the result will be efficient data processing service use across the organization.

At the same time, the data processing division itself is creating its own profitable pricing strategy. In order for profit-based pricing of data processing resources to effectively achieve this congruence, though, the organization must have a policy which permits outsourcing (DiNardo, 1992, pp.169-172). A permissive outsourcing policy allows divisions within the organization to purchase data processing resources from outside vendors if outside service is better. This has the effect of placing the organization's internal source for

data processing resources in direct competition with the outside market. It also frees the firm from the need to establish a price for data processing resources. This price will instead be determined by market forces.

There are three distinct advantages to profit-based pricing. The first advantage is that it can provide capacity planning information. If a data center is not realizing a profit, that may indicate that the center has more processing capacity than is needed. The data center then has the option to either eliminate excess capacity or possibly make services available to the outside market. The second advantage is that it forces the organization's internal data processing source to provide a superior product at a competitive price in order to stay in business. The third advantage is that the policy gives divisional managers the freedom to choose between internal and external data processing resources. This freedom is vital in organizations using the profit-center concept. As stated above, the a profit-center manager is evaluated by his division's profits. If managers are to have any control over this evaluation, they must be able to "exert significant influence over both revenues and costs." (Anthony, 1988, p.65) An organization which mandates internal sourcing for data processing resources takes away the manager's exchange autonomy - a significant element of managerial control.

In spite of this fact, many organizations restrict outsourcing (Eccles, 1985, p. 32). One common reason data

processing outsourcing is prohibited is that cost-conscious management personnel feel compelled to recover the investment they have made in data processing resources (CIS Comptroller interview, 1993). They accomplish this by using a cost-based chargeback method (discussion follows) and prohibiting outsourcing. Outsourcing is prohibited, because the "start-up" costs for a data center are high, and when these costs are distributed users must pay more than market price for a given service.

A second reason some organizations prohibit outsourcing for data processing resources is long-standing corporate policy (Telephone Conversation, CIS Comptroller, 1993). Many large corporations have a Corporate Information Services department which provides data processing services. Placing this department in direct competition with external data processing vendors creates a problem with externalities.

Externalities are "consequences of action that the actors don't take into account and that therefore don't influence their decisions." (Heyne, p. 330, 1991) They arise when autonomous though interdependent divisions must integrate and coordinate their actions. Suppose, for example, a department decides to contract with an application programmer to design a database system. They select the application programmer that offers the best price. Suppose later, another department fulfills the same requirement using the services of another database programmer who also offers the best price.

Chances are that the database programmers are not going to create systems which can share information. However, the two departments might need to do this at some point in the future. The need to share information is not something department decision makers would take into account when they made their decisions - they simply look for the best price to enhance their own profits. In the long run, their narrow-sightedness may cost the organization money. If data sharing becomes necessary, more money will be spent to make the two systems compatible.

Many companies avoid this type of externality problem by vesting a central department (i.e. Corporate Information Services) with sole procurement authority. Doing this eliminates the externality problem and allows the organization to realize "economies of scale, control, and coordination." (Birnberg, Hufnagel, 1989, p.424)

b. Cost-based Pricing (Lin, 1983, p.8)

The alternative to market-based prices for data processing resources is to base the price on cost - specifically, the company's cost in providing the resource. Cost-based pricing has several distinct advantages. It is simple, generally easy to administer, and meets the requirements of many government contracts and regulatory agencies. There are at least three methods of cost-based pricing: average cost pricing, standard cost pricing, and

flexible pricing. Each method (discussed below) has disadvantages as well.

(1) Average Cost Pricing (Lin, 1983, p.8). The average cost for a given level of data processing service is based upon the following formula:

$$\frac{\text{Total Cost Of Service}}{\text{Recorded Usage}}$$

This cost per unit which is charged to departments based upon the number of units consumed.

The primary advantage to this method is that, in theory, it appears fair. (Schechinger, Prack, 1983, p.45) Users pay for what they use. This method also allows the data processing center to recover its costs.

The disadvantages, though, are numerous. For example, it creates three inefficiencies. The first inefficiency arises because users are charged average total rather than marginal cost for data processing resource use. For efficiency, additional service should be provided as long as the benefit of additional service (marginal benefit) exceeds the cost of providing it (marginal cost). Computer systems typically have high fixed and low variable costs (Prack, Schechinger, 1983, p. 56). Therefore, for computer systems the cost for incremental use is low, and the average

total cost is greater than the marginal cost when the system is not used to capacity. Average cost pricing motivates users to demand service if their benefit is greater than its average total cost. As demonstrated in Figure 3, less is demanded at average total cost (Q_{ATC}) than at the point of efficiency, (Q_{MC}) - where marginal cost equals demand (marginal benefit). Q_{MC} is the efficient point. The result is system resource under-utilization.

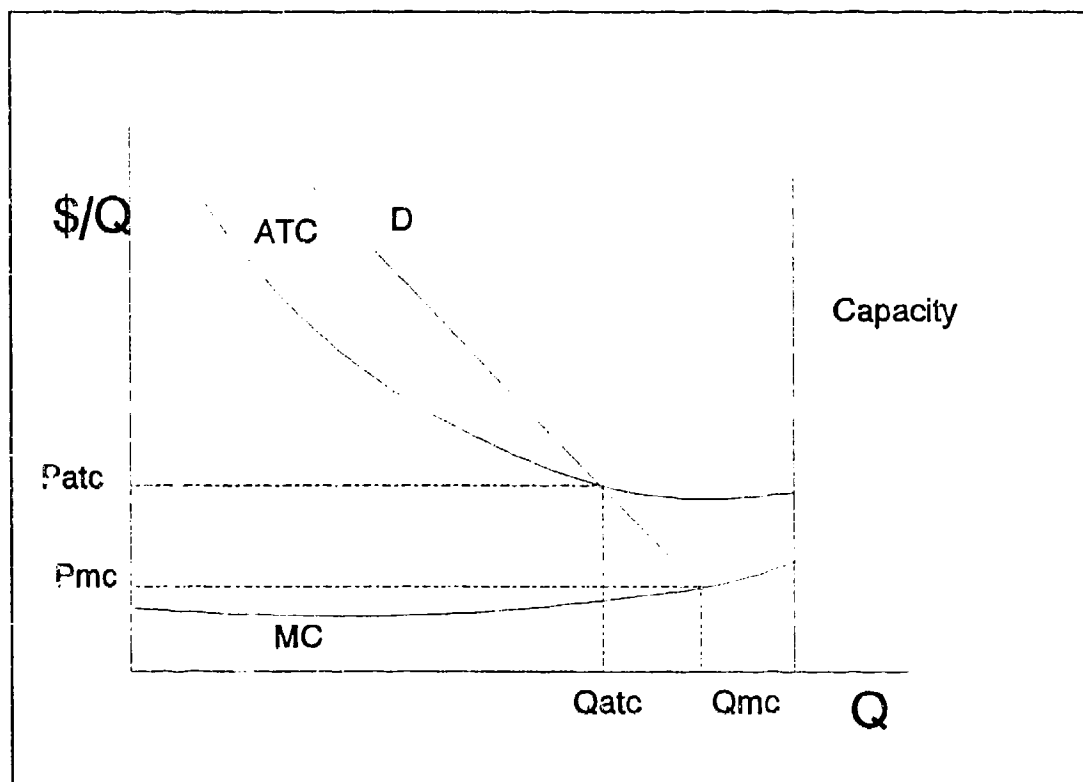


Figure 2. Average and Marginal Cost Curves

To illustrate this inefficiency, suppose that P_{ATC} equals five dollars and P_{MC} equals one dollar. The data processing service center will charge users five dollars for a service. Under average cost pricing, this is the point at

which the center breaks even. Users will seek alternatives (to the service) which cost \$4.99 or less. They are willing to pay as much as \$4.99 for an alternative to a service which only costs the organization \$1.00. This is the source of the inefficiency.

A second disadvantage is that average cost pricing can encourage undesirable behavior from a resource management standpoint. As stated previously, computer operations have high fixed and low variable costs. As a result, average total cost decreases as usage increases and increases as usage decreases. The problem this creates for average cost pricing is obvious. The price of the resource rises as demand decreases and the higher price further reduces demand. Conversely, the price of the resource drops as demand increases and the lower price increases demand. Average cost pricing, therefore, motivates users to behave in exactly the opposite manner that efficient resource use dictates.

The final inefficiency results because average costing does nothing to help ration usage for data processing during periods of excess demand. Users are charged the same fee regardless of the value or priority they assign to a requested task. If there are periods when demand exceeds capacity, the data processing center will not know which requests to process first.

(2) Standard Costing (Lin, 1986; McKinnon, Kallman, 1987). Standard cost pricing is based upon the same concept as average cost pricing (cost of service divided by total usage). However, standard cost pricing is based on the projected (rather than retroactively determined) cost of service. The price charged per unit of the resource remains fixed throughout a given time period.

Standard cost pricing has the advantage of allowing users to plan and budget for data processing resource use. However, it uses projected average total cost (ATC). Hence, it creates the same inefficiencies as average cost pricing. In addition, there is another distinct disadvantage. Unless it is based on very accurate estimates, one of two things may happen. The users may pay more for their data processing resources than it costs the company to provide (if their actual usage is below the projected usage), or they may pay less (if their actual usage exceeds the projected usage). In the latter instance, full cost recovery is not accomplished.

(3) Flexible Pricing (Potter, 1985, p.37; Lin, 1983, p.9). Flexible pricing schemes are based on demand rather than cost. In this respect, they are fundamentally different from the cost-based techniques discussed above. Flexible pricing uses a technique called differential pricing. Differential pricing sets different prices for different tasks

depending upon their priority or the time of day they are accomplished. Differential pricing includes both peak load and priority pricing.

Peak load pricing is used when shifts in data processing resource use are predictable. Peak load is defined as the period of highest demand for data processing resources. Off-peak periods are periods of lesser demand.

Peak load pricing attempts to efficiently allocate scarce data processing resources by distributing demand across time. This is accomplished by charging users more for resource use during periods of peak demand. The higher price encourages those users whose marginal benefit is less than the peak load cost to run their jobs during the off-peak periods when the prices are reduced.

Priority pricing is used when shifts in data processing demand are not predictable. With priority pricing, users are offered a choice of prices, each one corresponding to the priority their task will be assigned. When demand for the data processing resource exceeds supply, tasks with the highest priority (and the highest price) are processed first. Priority pricing improves efficiency in resource use by ensuring that resources are available to users who value their tasks the most (i.e., those who are willing to pay the higher price).

Peak load and priority pricing can satisfy many of the criteria for a successful chargeback scheme. One

drawback, though, is that these flexible pricing techniques can be difficult and expensive to administer and maintain. Configuration changes which affect capacity can require corresponding changes to the pricing scheme. A second disadvantage is that flexible pricing can make budgeting difficult for users. When prices are subject to frequent change, planning expenditures can be impossible. A final disadvantage is that flexible pricing, because it is demand rather than cost based, may not allow a firm to recover its costs.

IV. THE COMPANY AND THE CHANGE

A. INTRODUCTION

Hypothetical Computers and Electronics (HC&E), headquartered in San Mateo, California, is currently reorganizing its Corporate Information Services (CIS). This chapter begins by describing the company and its corporate culture. The second part of the chapter discusses the CIS reorganization effort and the reasons personnel are resisting the change. Section F discusses the method the company is using to overcome resistance to the transition. Section G describes briefly some current ideas on managing change. Data for the first two chapter sections were derived from several sources: corporate documents (a confidential company whitepaper and company-provided literature); published reports; and interviews with HC&E's Corporate Network Services Manager, Internal Change Consultant (referred to henceforth as the ICC), and CIS Comptroller. Data for the final chapter section were obtained from the consulting organization HC&E hired to help manage the change.

B. HYPOTHETICAL COMPUTERS AND ELECTRONICS

HC&E was founded 53 years ago by Dave Houston and Bill Pickford, two engineers educated at Stanford University. Since then, it has grown from a small privately-held

organization into an international company with 91,000 employees and net sales in excess of 13 billion dollars.

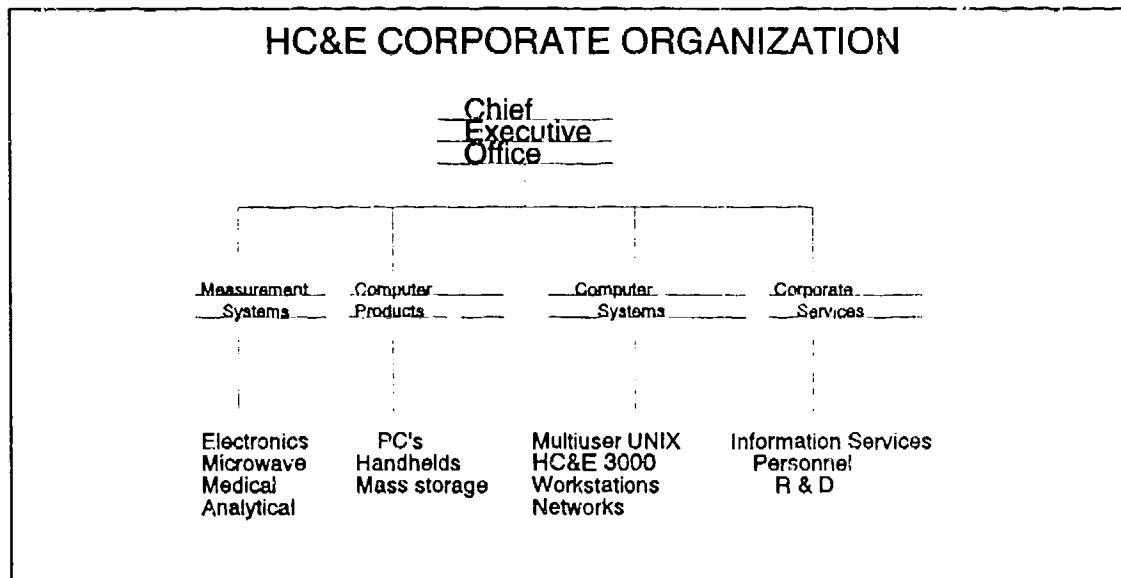


Figure 4. HC&E Organizational Chart

HC&E manufactures and markets 20,000 major consumer electronic and computer products (HC&E Business Overview, 1989). The company is divided into four sectors, three of which concentrate on specific product lines. (See Figure 4.) The sectors are further sub-divided into divisions. Sector one is responsible for measurement systems, sector two for computer products, and sector three for computer systems. The fourth sector provides corporate services for HC&E employees.

C. HC&E CORPORATE CULTURE

HC&E's corporate culture is based on the "HC&E Way"

Hypothetical Computers defines the HC&E way as:

a set of deeply held beliefs that govern and guide our behavior in meeting our objectives and in dealing with each other, our customers, shareholders and others. (The HC&E Way, p. 1)

These beliefs include:

- the understanding that people want to do a good job, and "will do so, given the proper tools and support" (The HC&E Way, p. 1)
- the promise of employment security
- egalitarianism - management and the employees they manage receive the same benefits and work in the same "open-office" conditions. Atmosphere is informal. MBWA (Management by wandering around).
- a strong climate of mutual trust
- a strong focus on teamwork
- decentralization - organization based on small autonomous units - each of which has its own profit/loss accountability (ICC interview, 16 October 1992)
- participative management - decisions are arrived at "democratically," personnel at all levels have the opportunity for input
- encouragement of flexibility and innovation

D. THE TRANSITION

Corporate Information Services (CIS) has been the target of HC&E's most recent efforts to reduce its internal organizational costs. Specifically, two proposed changes will affect the way HC&E manages its information technology (IT)

resources. The first change is to realign the business and IT strategies. IT is no longer being viewed as a cost to be subtracted from the "bottom line;" instead it is viewed as an "enabler" - a technology which can increase the organization's bottom line by improving the way it does business (ICC interview, 16 October 1992).

The second change is physically consolidating 30 data centers into six. This consolidation is being undertaken for several reasons (*T&M Information Technology Whitepaper*, 1992). The primary reason is that improvements in network technology and distributed processing capabilities make the power and efficiency of centrally located computers available to geographically and functionally separated divisions. A secondary but related reason is that consolidation permits HC&E to realize economies of scale. It costs less for one large data center to perform a given function for a large group of people than it does for several small centers to perform the same function for several small groups of employees. HC&E anticipates this consolidation will save \$2.5 million (net present value) in data processing costs over the next five years. (*T&M Information Technology Whitepaper*, 1992, p. 11)

E. RESISTANCE TO CHANGE

Most employees recognize that this change will save their company money. Nevertheless, management has encountered

strong resistance to consolidation. (ICC interview, 16 Oct 1992) The sources of this resistance are numerous. First, some employees are threatened by potential job loss. For years, HC&E has prided itself on its "cradle-to-grave" employment policy. The consolidation, though, will make some "lay-offs" necessary. Many IT employees also expected that working for HC&E would allow them to remain in one geographic area for life. The consolidation will require some employees to move; some of the relocations will geographically separate husband and wife employees.

The consolidations are also encountering resistance because of the "not-invented-here" syndrome. (ICC interview, 16 October 1992) HC&E personnel have long been accustomed to using decentralized IT services they had designed to suit their division's needs. Now they are being required to use centralized services which may not satisfy their unique requirements.

HC&E management is attributing much of the change resistance to human nature. (ICC interview, 16 October 1992) Human beings need to feel in control of their destinies, and a change imposed from above severely reduces this control. Most employees are "threatened by the greater ambiguity" and view the change as having "more costs than benefits." (ICC interview, 16 October 1992)

HC&E's ICC attributes the change resistance to "counter-cultural" method by which it was imposed. (See Section C for

discussion of HC&E's corporate culture.) The decision to consolidate was made by top management; it was not arrived at "democratically." The lay-offs and involuntary relocations have weakened the management/employee mutual trust. Centralizing IT services deprives the decentralized business units of some of their flexibility and autonomy - and affects the influence they have over their own "bottom-lines."

F. PHILOSOPHY OF INTERVENTION

In an effort to overcome the resistance to the consolidation, HC&E is using the MOC (Managing Organizational Change) change technology, a philosophy of intervention purchased from an external consulting organization ("ODR"). [This organization's address is given in the List of References.] The following description of their philosophy is based on information conveyed in ODR's two-day course entitled "Managing Organizational Change Implementation Planning Application."

In the first phase, an organization, prompted by "pain," undertakes a change project and moves into the "transition phase." After this phase is successfully negotiated, the organization applies the chosen "remedy" and then moves into its desired state.

The terms this technology uses require further explanation. "Pain" is the discomfort people experience when exposed to information which justifies altering the status

quo. For most people, the status quo is comfortable. Unless they are presented with information which makes them uncomfortable, they have no incentive to change. Convincing people to move into the "transition phase" requires "pain management" - a process in which an organization selectively reveals information in an effort to generate discomfort sufficient that people willingly leave the status quo.

HC&E is currently in the transition phase. According to the MOC philosophy, an organization in the transition state exhibits the following characteristics:

- low stability
- increased conflict
- abundant energy

Successfully negotiating this unstable phase requires the organization concentrate its efforts in three areas:

1. cultivating the change management skills of the change agent
2. effectively managing the target resistance
3. ensuring that the change project is culturally aligned

Step one requires that HC&E select change agents and train them to perform step two. Step two requires first that the change agents identify "targets" (i.e., those people whose work conditions will be changed) and then forecast the degree and source of their resistance. The MOC model identifies two

potential sources of resistance: ability deficiency and willingness deficiency. An ability deficiency exists when targets resist change because they do not believe that they will have the skills necessary to perform their new jobs. A willingness deficiency exists when the targets are opposing the change in spite of having been exposed to the facts on which top management based the decision.

The technology recommends a different course of action for each of the two reasons for resistance. For ability deficiency, change agents must ensure that targets are sufficiently trained. For willingness deficiency, the model recommends penalizing the non-supportive behavior with whatever measures the company normally uses. Throughout this entire process, the change agents must focus on step three-making sure that the change project is culturally aligned. This entails understanding what the targets' previous company experience has led them to expect and ensuring that their expectations are fulfilled.

G. CHANGE THEORY AND OVERCOMING RESISTANCE TO CHANGE

In comparison with HC&E's change technology (discussed above), the literature on managing major organizational change suggests that employees resist change for four reasons: "a desire not to lose something of value, a misunderstanding of the change and its implications, a belief that the change does not make sense for the organization, and a low tolerance for

change." (Kotter and Schlesinger, 1986, p.67) The literature also suggests several methods for overcoming change resistance (Kotter and Schlesinger, 1986, p. 70-74; Lawrence, 1954, p.195; Kanter, 1984, 674). These methods include:

- Education and communication: educate affected personnel about the change before it happens and communicate the reasons behind the change; educate them to provide them with the skills necessary to function in the new environment.
- Participation and involvement: allow affected personnel the opportunity to participate in making change-related decisions
- Facilitation and support: allow affected personnel the opportunity to openly discuss their change-related anxieties; provide them with compensation (more money/time-off) for extra workload created by change
- Negotiation and agreement: if possible, offer incentives to affected personnel, i.e. increased salaries following successful implementation of change

There are two strong similarities between the MOC philosophy and the change literature. The first similarity is that both approaches acknowledge that change resistance exists because employees do not appreciate the need for the change. The second similarity is that both approaches emphasize education and communication. The MOC philosophy recommends providing personnel with enough information that they are willing to leave the status quo. The change literature recommends communicating to personnel the reasons for the change. Both approaches also emphasize educating personnel to

ensure that they have the ability to function in the post-change environment.

There are three notable differences, though. One is that change literature reviewed for this thesis, did not specifically discuss the idea that personnel should be trained to manage change. The MOC philosophy is founded on the idea that managing change is a skill an employee can learn. The second notable difference is that the MOC philosophy recommends essentially a punitive approach to willingness deficiency. The change literature, on the other hand, takes the more gentle approach and recommends facilitation and support.

A third notable difference between the MOC philosophy and the change literature is that the MOC philosophy emphasizes cultural alignment. The change literature reviewed for this thesis did not mention culture, although it did mention participation and involvement, ideas central to HC&E's corporate culture.

V. HC&E'S CHARGEBACK POLICY

A. INTRODUCTION

HC&E has decided to charge personnel for use of the consolidated Information Technology Centers (ITC's). This chapter describes the controversy surrounding the decision and the method the company is using to establish a chargeback policy. This chapter also outlines the chargeback objectives the company is using, the services each ITC will charge for, and the aspects of the chargeback policy thus far established. Data for this chapter are derived from two extensive and two short follow-up interviews with HC&E's CIS Comptroller.

B. HC&E'S EXPERIENCE WITH CHARGEBACK

One of the most thorny and most divisive issues surrounding HC&E's consolidation effort is the chargeback policy. For the first time in HC&E's history, users are being required to transfer funds outside their divisions to pay for data processing services. Both the method by which the policy is being developed and the policy itself are being hotly contested by the four employee groups affected: data processing professionals, accounting personnel, division managers, and the end-users.

HC&E's first step was to create an internal task force consisting of the four groups of personnel affected: data

processing, accounting professionals, managers, and end-users. After the first few meetings, the company decided to exclude managers and end-users from the task force because their presence made it impossible for the group to agree on a chargeback policy. The resulting task force consisted only of data processors and accounting professionals. Their first task was to determine the chargeback policy's objectives.

1. Chargeback Objectives

Their consensus was that the chargeback policy should:

1. Recover the company's data processing investment
2. Enable customers to predict how much they will be charged for computer services
3. Enable customers to realize savings through their actions (i.e., be controllable) using billings based on utilization
4. Create a partnership between the customer and the ITC's which improves the efficiency of both (i.e., motivate efficient behavior using pricing structure)
5. Be easily understood by all affected
6. Appear equitable to all concerned
7. Be flexible to accommodate changes in customer and business needs
8. Charge prices which are competitive with the market price for the same service
9. Provide capacity planning information
10. Encourage competition among each of the six consolidated Information Technology Centers (ITC's)
11. Encourage use of ITC services

The task force then had to agree on a standard definition for "service." The ITC's provide many services; which ones should the user be charged for? Thus far the consensus among task force members is that users should be charged for those services which they cannot provide less expensively within the organization for themselves. These services are:

- Electronic mail
- Access to on-line databases
- Computer processing time (measured in CPU cycles)
- Information storage space (measured in disk sectors)
- Use of centrally available standard applications (e.g., HP's inventory and accounting systems)
- New application development
- Training and customer assistance

2. Chargeback Policy Decisions

After the above decisions were made, the task force began outlining its chargeback policy. Thus far, the following decisions have been made:

- Users will not be permitted to contract outside the organization for data processing services (i.e., outsourcing will be prohibited)
- Each of the six ITC's will be allowed to establish their own rates within the following parameters:
 - Rates charged must accomplish cost recovery

- A differential pricing structure must be used which charges a lower rate for 5 day a week/8 hour a day access than 7 day a week/24 hour a day access
- 80% of services provided should be standard and have a fixed price; the other 20% should be "customized" services and have prices which are negotiated with the divisions on a case-by-case basis
- Divisions will be permitted to purchase services from any of the six ITC's.

VI. ALTERNATIVE APPROACHES TO CHARGEBACK

A. INTRODUCTION

HC&E'S situation is not unusual. Tighter information system budgets have forced many organizations to consolidate data processing resources and charge for service use.

This chapter first discusses one organization which has confronted chargeback issues similar to HC&E'S. The organization's solution will be discussed and then compared and contrasted with HC&E's approach. The second half of the chapter is a more general discussion of the approaches other organizations have taken to implementing chargeback.

B. SPECIALTY PUBLISHING, INC.

Hufnagel and Birnberg (1989) studied Specialty Publishing, Inc.'s (SPI) effort to revise its existing chargeback policy.

1. The Company and Its Data Center

SPI is a "communications company that provides specialized information and related services to health care professionals." (Hufnagel and Birnberg, 1989, p.420) SPI's data center employs 32 people and has a \$3 million yearly budget.

The data center has two computers. One computer provides word processing capabilities and the second, an IBM mainframe, supports the organization's general processing

requirements (maintaining client databases, printing mailing labels, etc.). SPI uses 90% of the first computer's capacity and only 40% of the second computer's.

2. The Chargeback Environment

SPI decided to dramatically change its chargeback policy. Prior to this decision, the company used a two step process to calculate user rates. First, a standard job accounting package was run to calculate the kind and amount of resources used by each job. Then, these resource amounts were multiplied by a fixed rate schedule to arrive at a final bill. The fixed rate schedule had been established "arbitrarily" by the data center supervisors and the rates were significantly below the market price. (Hufnagel, Birnberg, 1989, p.421) The rates were also significantly below cost; the data center was operating "in the red."

SPI's executive committee did not like the fact that the data center was not "breaking even." They were concerned about two additional problems as well:

- users abusing data processing resources because they were not being forced to pay full cost
- underutilization of the IBM mainframe

These concerns prompted them to:

- implement a standard cost pricing scheme in which data processing costs would be projected in advance and charged out "equitably" to each of the divisions
- prohibit purchase of computer services from outside vendors
- require the MIS manager to sell computer services to users outside the organization in an effort to achieve full utilization of data processing equipment

These decisions were hotly-contested by both the data center's manager and users. The manager believed that the new higher prices would inhibit users' attempts to experiment with the computer and find useful applications for data processing. He also believed that the discussions between department managers and cost analysts necessary to project the costs would create additional conflict within the organization. His primary concern, though, was that users' response and job turnaround time would suffer because the system they were using was also being used by outside organizations.

The users were unhappy because internal prices were above market level and they were not being allowed to seek better prices on the open market. The manager of one division decided to purchase personal computers in an effort to re-establish control over his data processing costs. The manager of a second division formally protested the decision to prohibit outsourcing. Birnberg and Hufnagel noted that "none of the managers indicated that they planned to review

their current data processing activities to identify jobs that could be run less frequently or discontinued altogether." (Hufnagel, Birnberg 1989, p.422)

3. Resemblance to HC&E

SPI's experience with chargeback resembles HC&E's in several respects. Both companies are in the midst of a transition. HC&E is consolidating its ITC's and requiring users to "pay" for services for the first time and SPI is now requiring users to pay full cost. Users and managers within both companies are unhappy about the new pricing structures. Both companies are focusing on recovering data processing costs and both organizations hope that their chargeback schemes will encourage personnel to make cost-conscious decisions concerning data processing resource use. Additionally, both companies are using standard cost pricing. Finally, both companies have decided to prohibit outsourcing.

4 Differences from HC&E

One difference between the two companies is that HC&E has stated that one of its goals is to establish prices which are competitive with the market prices. SPI is charging users prices which exceed the market price. Because SPI's divisions are evaluated as profit centers (a concept discussed in Chapter III, Section 3a), managers are understandably distressed about having lost the ability to purchase a needed service at the lowest available cost. It is interesting to

note too that one SPI manager decided to purchase personal computers to regain control over his data processing costs - a decision which may not have been efficient from the company's viewpoint. (See discussion in Chapter III, Section 3b(1).)

A third difference is that SPI is requiring its data center to sell its services on the open market. HC&E's data center services are used only within the company. One interesting question raised by SPI's requirement is: given the fact that "full-cost" recovery is forcing the data center to charge more than the market price for its services, how is it going to sell any of its services on the open market?

C. CHARGEBACK PRODUCTS

Many companies use "chargeback products," installed computer software which performs various chargeback functions. There are currently about 30 of these products on the market (Butler, 1992, p.50); the three most popular are:

1. MICS Accounting and Chargeback: accounts for system usage and also accumulates data to assist in capacity planning, optimization, and system tuning
2. KOMAND III: accounts for system usage and also features a "Universal Charge Interface" (UCI) which permits the data center to accumulate charges using any machine readable record

3. CA-JARS/CA-PMA: mentioned most frequently in the literature, designed to be used by people with financial accounting backgrounds, shifts responsibility for implementing chargeback from data processing to financial accounting personnel

D. OPPONENTS OF CHARGEBACK - SEARS MORTGAGE COMPANY

Sears Mortgage Company located in Riverview, Illinois does not charge for use of its centralized data processing services. According to the Senior Vice President of Information Services, this policy is pursued for three reasons:

- It is not Information Systems' job to control the business - IS should support the business
- Chargeback encourages bad business decisions
- Chargeback typically only accounts for machine usage, which is now only a small percentage of the company's data processing costs (Butler, 1992, p.49).

The company instead uses a cost/benefit approach to data processing spending. The company's cost in providing the service is balanced against the benefits or savings the company realizes in using the service.

According to Sidney Finehirsh, President of Compumetrics, Inc., a consulting firm specializing in the design of chargeback policies, Sears Mortgage Company is an excellent example of a company which should not institute chargeback. Finehirsh says that companies which should not use chargeback should have:

- divisions which are geographically concentrated
- a unifying corporate culture
- personnel with the same goal (i.e., non-competitive divisions)
- confidence in IS (Butler, 1992, p.52)

E. CHARGEBACK IN AN ACADEMIC ENVIRONMENT - LAWRENCE/BERKELEY LABS (Butler, 1992, p.51)

Lawrence/Berkeley labs located in Berkeley, California has a central computer facility used by scientists and engineers who model physical and chemical processes. The manager of the central facility, in an effort to use excess capacity, decided to sell services to outside users. This additional use adversely affected both the system's job turnaround and interactive response time. The scientists and engineers responded by abandoning the central facility and purchasing their own small computers, thus making a decision which improved their individual situations but not the situation of the organization as a whole.

VII. ANALYSIS OF HC&E'S CHARGEBACK APPROACH

A. INTRODUCTION

This chapter is an analysis of HC&E's chargeback policy and the process by which it has been established. The analysis is based upon the theory and ideas described in the preceding chapters. The first part of the chapter is a general discussion of the strengths and weaknesses of HC&E's chargeback policy. The second part addresses the problems inherent in the chargeback goals the company has established. The third part discusses the implications of the policy decisions the company has already made.

B. HC&E'S APPROACH: PRO'S AND CON'S

1. Strengths

HC&E's approach to chargeback has one clear strength: its objectives. The company outlined them prior to establishing the policy itself, and each objective corresponds to an objective or criteria listed in Chapter II. These objectives include, cost recovery, predictability, controllability, motivating efficient behavior, understandability, equitability, flexibility, achieving fair market prices, providing capacity planning information, encouraging competition, and encouraging use. If all of the

objectives could be achieved, the result would be an "ideal" chargeback system.

2. Weaknesses

The primary weakness of HC&E's approach is that all the objectives cannot be achieved simultaneously. Some of the objectives can only be achieved at the expense of others. This will be discussed in greater detail in Section C.

Another weak point of HC&E's approach is the process by which the company is establishing its policy. The task force consists only of data processing and accounting personnel. The two other groups which will be affected by the chargeback policy, end-users and division managers, have not been included.

This exclusion is bound to have negative results. Excluding end-users and managers will make it impossible to achieve several of the company's chargeback goals. For example, goal five: "be easily understood by all affected," is unlikely to be achieved by a team composed of only data processors and accountants. Additionally, a chargeback policy which is difficult to understand will probably not achieve goal two: "enable customers to predict how much they will be charged for computer services."

Goal six: "appear equitable to all concerned" is also jeopardized by this exclusion. Hufnagel and Birnberg (1989) state that employees not involved in a decision-making process

generally consider the decision to be "unfair." The consequences of this perceived unfairness can have unfortunate affects on the organization. As Thompson states, "Control systems that are perceived to be inequitable may also trigger a variety of unanticipated, dysfunctional behaviors as managers experience diminished autonomy and attempt to circumvent the system."

Goal seven: "be flexible to accommodate changes in customer and business needs" will not be accomplished if the task force working on the chargeback policy consists only of data processors and accountants. Data processors and accountants are unlikely to be aware of changes in customers needs. Unless a vehicle is established for communicating changing needs to the chargeback policy makers, goal number seven will not be achieved.

The process to establish HC&E's chargeback policy also violates some of the change theory recommendations discussed in Chapter IV, Sections F and G. These recommendations were:

1. Addressing ability deficiencies
2. Addressing willingness deficiencies
3. Ensuring cultural alignment
4. Educating and communicating with affected personnel
5. Encouraging participation and involvement in the change
6. Facilitating and supporting personnel during the transition

7. Negotiating with personnel on the terms of the transition

For example, the ability deficiencies mentioned in recommendation one exist because people do not feel sufficiently trained to work in the new environment. This feeling increases when affected personnel have little influence on aspects of the new environment's structure - in this case the chargeback policy. Willingness deficiencies, too, are exacerbated when personnel are not included in creating a policy which will affect them. Including them in the decision process would have allowed them the opportunity to examine the facts on which the company based its decision to consolidate and institute chargeback. HC&E also violated recommendations three and five in instituting its chargeback policy. Both HC&E's culture and change management theory encourage participation in the decision-making process. HC&E's decision to exclude groups of affected personnel may exacerbate resistance to the transition.

A third weakness of HC&E's chargeback approach is the decision to measure usage in machine time units (CPU cycles and disk sectors). As stated in Chapter II, Section B.2., these units are meaningless to most users. Users are not able to see a relationship between their computer use and what they are being charged. A more effective approach is to use natural billing units (e.g., number of invoices processed, number of checks printed, etc...).

C. HC&E'S CHARGEBACK OBJECTIVES

1. Incompatibility

Some of HC&E's chargeback objectives are incompatible with other objectives. For example, the first objective, cost recovery, may preclude objective eight (market prices) and objective 11 (encourage use of ITC services). Objective two, predictability, may be achieved at the expense of flexibility, objective seven. Similarly, an emphasis on cost recovery may make it impossible to achieve objective four, incenting efficient behavior using pricing structure. These incompatibilities make it necessary for HC&E to prioritize their chargeback objectives. Not all of these can be accomplished at once.

2. No "Perfect" Chargeback Method

No one chargeback method can accomplish all of these objectives. As Table one demonstrates, each method accomplishes some of the objectives. The chargeback methods discussed in Chapter III (free allocation, direct allocation, profit based pricing, average cost pricing, standard cost pricing, and flexible pricing) are listed across the top of the table and HC&E's chargeback objectives are listed on the side. Some methods have been designed to accomplish a specific objective. These are indicated with a "Y" in the box created by the intersection of the method and the objective. Other methods have the potential to satisfy a given objective

if other circumstances are present. These are indicated with a "Y/N" and require further explanation (see below). "Unclr" is used to indicate that it is difficult to predict whether or not the chargeback method will accomplish the objective. Empty cells indicate that the method will not accomplish the objective.

TABLE 1. MAPPING OF CHARGEBACK OBJECTIVES TO METHODS

Method Objective	FA	DA	PB	AC	SP	FP
1.Recovers Cost		Y	Y/N	Y	Y/N	Y/N
2.Predictable		Y			Y	
3.Controllable			Y/N	Y/N	Y/N	Y/N
4.Motivate Efficient Behavior			Y/N			Y/N
5.Understandable	Y	Y	Unclr	Y	Y	Y
6.Equitable	Y	Y/N	Unclr	Y	Y	Y
7.Flexible						Y/N
8.Market Price			Y			
9.Capacity Planning			Y			Y/N
10.Encourage Competition			Y			Y
11.Encourage Use	Y	Y	Unclr	Y/N	Y/N	Y/N

FA = Free Allocation Method
 DA = Direct Allocation
 PB = Profit-Based Pricing
 AC = Average Cost Pricing
 SP = Standard Cost Pricing
 FP = Flexible Pricing

Y = Yes
 Y/N = Possibly
 Unclr = Unclear

The following list is a discussion of the Y/N entries in Table 1. As stated above, these entries are the circumstances which must be present if the chargeback method is to satisfy the given objective. The number and letter in parentheses correspond to the objective and method in the table above.

- (6, DA) Direct allocation accomplishes goal six if personnel consider the allocated charges "equitable." Under equitable allocation, each user receives the same treatment (i.e., receives an "equitable" amount of computer time).
- (1, PB) Profit-based chargeback recovers cost if the data center is able to charge prices which allow cost recovery.
- (4, PB) Profit-based chargeback motivates efficient behavior (i.e., encourages individual-organizational goal congruence) if it is used under "perfect" market conditions. Under ideal market conditions, each user consumes computer time up to the point at which his/her marginal cost equals his/her marginal benefit. This is the point of efficiency. (Point of efficiency discussed in Chapter III Section 3,B,(1))
- (11, AC) Average cost pricing encourages use when prices are low (i.e. when recorded usage is high). The average cost formula (total cost of service divided by total usage) produces a low price when usage is high (i.e., when the denominator is large).
- (1, SP) Because the standard cost formula (total cost of service divided by total usage) is based on projected costs, this method will recover costs if the projections used to estimate the costs are accurate.
- (3, PB, AC, SP) Profit based, average cost, and standard cost pricing are controllable if the user can control his charges through use and the prices are not subject to change without notice.
- (11,SP) Standard cost pricing encourages use if users perceive the prices to be "low" or cost effective given the benefits to be gained from the service. The standard cost pricing formula produces a per unit cost figure which users can compare to the benefit they receive from the service.

- (1, FP) Flexible pricing recovers cost if the pricing structure permits. The prices charged must enable the data center to recover its cost.
- (3, FP) Flexible pricing is controllable if the user can control his charges through use and the prices are not subject to change without notice.
- (4, FP) Flexible pricing motivates efficient behavior to the extent that use during peak times and high priority jobs are discouraged by higher prices. Because prices are higher for high priority jobs and during peak usage time, the users submit only jobs they value highly.
- (9, FP) Flexible pricing can provide capacity planning information by charging very high prices during "peak" times; these high prices can signal to management that the demand for available capacity is exceeding the supply.
- (7, FP) Flexible pricing is "flexible" (i.e. changing to meet changing customer needs) in the respect that it uses peak load and priority pricing techniques. If, for example, the need to run jobs at 6:00 AM increases dramatically, the price of those jobs may be increased to regulate the demand.
- (11, FP) Flexible pricing encourages use during off-peak hours. During off-peak hours the prices are lower and lower prices encourage use.

D. HC&E'S CHARGEBACK POLICY

The policy decisions HC&E has made thus far indicate that some of the stated objectives have priority over other objectives. Decision one, prohibiting outsourcing, implies that cost recovery is more important to HC&E than pricing computer services at their market value. Decision two, both requires cost recovery and stresses standard cost pricing, a strategy which can make cost recovery impossible. Decision three, which places the six ITC's in competition with each

other, may motivate efficient behavior, but it may make cost recovery impossible across all six centers.

HC&E's decision to institute a chargeback policy is also supported by Butler's (1992) discussion of the Sears Mortgage Company in Chapter VI Section D. Three of the reasons Sears elected not to institute a chargeback policy were: 1) their divisions were geographically concentrated, 2) the divisions were non-competitive, and 3) the company had confidence in IS. HC&E, on the other hand, has divisions all of the world, the divisions are competitive with one another, and company is concerned with the amount of money it is spending on IS.

E. EPILOGUE

The final thesis interview with HC&E's Corporate Information Services (CIS) Comptroller was held on 15 September 1993. As of this date, the chargeback policy is still causing considerable controversy. The policy decisions described in Chapter V Section B are being implemented and many division managers believe that their data processing charges are excessive and unfair. The Comptroller is currently working on a "transition plan" which he hopes will remedy some of these perceived inequities over the next few years.

VIII. FINDINGS AND CONCLUSION

A. INTRODUCTION

This thesis' purpose was to analyze one company's approach to solving its data processing chargeback problems and derive conclusions from which DOD could benefit. This analysis was done in the context of the three methods by which chargeback is commonly accomplished: free allocation, direct allocation, and direct chargeback, including profit-based pricing, average cost pricing, standard cost pricing, and flexible pricing.

B. FINDINGS

1. Unattainable Chargeback Policy Objectives

HC&E's stated chargeback objectives cannot all be accomplished by any one of the chargeback methods described in the literature. This means that one of the two following things must happen:

1. HC&E will have to prioritize its objectives and select the chargeback method which accomplishes the largest number of its highest priority objectives.
2. A new method of data processing chargeback must be created which will accomplish all of the stated objectives.

2. Incompatible Chargeback Policy Objectives

Unfortunately, bullet two (listed above) is impossible because several of HC&E's chargeback objectives are incompatible. Accomplishing one objective makes it impossible

to accomplish others. Again, it will be necessary for HC&E to prioritize their chargeback objectives.

3. The Importance of Corporate Culture and Effectively Managing Change

The resistance HC&E is encountering to the proposed consolidation is being exacerbated by the company's decision to exclude key personnel. This decision runs contrary to HC&E's corporate culture which emphasizes participation and disregards an important tenet of change management theory: employee participation and involvement. The decision also runs contrary to the philosophy of intervention the company is using to manage the change (MOC). The MOC philosophy emphasizes cultural alignment, ability deficiency, and willingness deficiency. Cultural alignment is not being achieved. Ability and willingness deficiency, both of which can be remedied by participation, training, and communication, are also not being addressed by HC&E's approach.

4. Data Processing Chargeback: a Divisive Issue

Both HC&E and SPI's experience with chargeback indicate that creating a chargeback policy which will satisfy everyone is difficult. Each stakeholder has a different set of priorities and invariably these priorities conflict.

C. Pertinence to DOD

There are several things DOD can learn from both HC&E's experience and the analytical context discussed in this thesis. DOD uses resource allocation systems designed to accomplish cost recovery. The unit cost system, implemented by DOD Principal Deputy Comptroller Donald Shycoff in fiscal year 1991, is based on the cost recovery concept. "All costs incurred in a functional support area are accumulated to determine a total cost. The total cost is then divided by the total expected work load or output. The resultant cost is a cost per unit of output, or the unit cost." (Seiden, 1991, p. 23) This cost becomes the "price" an activity pays for receiving a good or a service.

Unit costing was instituted to accomplish three objectives:

1. Encourage consumers to be cost-conscious
2. Encourage producer efficiency
3. Encourage activities to "break even," (i.e. recover costs)

DOD's focus on objective three, though, makes it impossible for objectives one and two to be accomplished. Prices set to recover costs do not necessarily encourage producer efficiency. (Gates, Terasawa, 1992, p.24) A second and related problem is that prices based purely on costs do not necessarily encourage consumer cost consciousness, nor can they be manipulated to influence consumer attitude and

behavior (Potter, 1986, p. 94) As discussed in Chapter II, Section C, Subsection 4, an effective chargeback system can be used to communicate management policy. This can only be done, though, if the system has sufficient flexibility. A focus on cost recovery, and the rigid application of billing algorithms, result in an inflexible chargeback system which cannot act as a vehicle for communicating management policy or user needs (Chapter II, Section C, Subsection 6).

Another problem with the cost recovery approach is the method by which DOD calculates costs. DOD uses total cost as the basis for the unit costs assigned. Total costs include direct, indirect costs, and depreciation (Seiden, 1991, p.25). One of the criteria by which a chargeback system's merit can be measured is whether the charges are controllable (i.e., whether users can control charges through their behavior). Neither indirect costs or depreciation are controllable.

Another potential concern surfaced during a 9 December 1993 interview with CDR Rod Robertson, former Commanding Officer of NCTS (Naval Computer Telecommunications Station), New Orleans. DOD uses complicated billing algorithms similar to the one depicted in Chapter II, Section D, for its computer and telecommunications services. Cryptic billing algorithms are strongly discouraged by the existing chargeback literature. The literature recommends instead using natural billing units, such as number of invoices processed or database queries processed. As discussed in Chapter II,

Section D, the natural billing unit allows users to see a direct relationship between what they use and what they pay.

Another lesson DOD can learn from this thesis pertains to managing major organizational change. DOD typically institutes change autocratically rather than democratically. There are of course, circumstances peculiar to DOD which occasionally make this method of imposing change necessary. There are other circumstances, though, in which DOD might benefit from the more "democratic" approach advocated by the change management literature discussed in this thesis. Two examples are Total Quality Leadership (TQL) and unit costing. DOD is currently in the process of instituting both of these new approaches and the changes are being resisted. The resistance stems in part from the fact that DOD personnel do not understand why the changes are being made. As discussed in Chapter IV, Section D, DOD needs to communicate to personnel the reasons behind the change. DOD also needs to ensure that personnel have the skills necessary to function effectively in the post-change environment.

DOD can learn from the mistakes HC&E's made in instituting its chargeback policy. As discussed previously in this chapter and in Chapter VII, HC&E elected to leave major stakeholders out of the process which implemented its chargeback policy. DOD makes this mistake as well. While it is often impossible for DOD to include representative stakeholders in the policy-making process, it is not

impossible to involve them in implementation. Allowing affected personnel some control over their destinies decreases their resistance to the proposed change.

D. AREAS FOR FURTHER STUDY

This thesis suggests several areas in which further research might be done.

- How is DOD establishing its own fee-for-service (chargeback) relationship with the organizations which will be using the consolidated data processing centers?
- Is there a "best-fit" approach, i.e., can guidelines be established which allow a company to assess its own situation and select a chargeback method which suits its needs?
- Data centers now provide more than simply mainframe computer processing time. Given this fact, what alternatives to the traditional chargeback methods can be proposed to charge for services such as user assistance, training, consultation, bulletin board availability, etc...?
- Administrative overhead must be considered when selecting a chargeback method. What methods can be used to quantify administrative overhead?
- What are the dysfunctional consequences of an ill-conceived chargeback policy and how much can these consequences cost an organization?
- How can an organization's culture be used to facilitate organizational change?

LIST OF REFERENCES

Alley, R.L., and Willits, S.D., "Capacity Based Pricing Offers Viable Chargeback Alternatives," *Data Management*, v.23, n.11, pp.22-28, November 1985.

Anthony, Robert N., *The Management Control Function*, Harvard Business School Press, 1988.

Bernard, Dan, and others, *Charging for Computer Services: Principles and Guidelines*, p.2, Petrocelli, 1977.

Butler, Janet, "Does Chargeback Show Where the Buck Stops?", *Software Magazine*, v.12, n.5, pp. 48-55, April 1992.

DiNardo, George, "Outsourcing Works - With the Right Business Plan: Successful Sellouts," *Corporate Computing*, v.1, n.4, pp. 169-172, November 1992.

Drury, D.H., "Conditions Affecting Chargeback Effectiveness," *Information and Management*, v.5, n.1, pp.31-36, March 1982.

Eccles, Robert G., *The Transfer Pricing Problem*, D.C. Heath and Company, 1985.

Endoso, Joyce, "Pentagon Plans to Move IT Systems Oversight to DISA," *Government Computer News*, v.11, n.17, p.6, August 17, 1992.

Gates, William R., and Terasawa, Katsuaki L., *Implementing Unit Costing: Efficiency in Translating Policy to Practice*, Working Paper, Naval Postgraduate School, Monterey California, 1993.

Heyne, Paul, *The Economic Way of Thinking*, MacMillan, Inc., 1991.

Hill, Sandra M., "Data Processing Chargeback", *Armed Forces Comptroller*, v.24, n.2, pp.12-14, May 1979.

HC&E Business Overview, (Slide Presentation), Provided by HC&E Corporate Network Services Manager, dated November 1989.

Hufnagel, Ellen M. and Birnberg, Jacob G., "Perceived Chargeback System Fairness in Decentralized Organizations: An Examination of the Issues," *MIS Quarterly*, pp. 414-429, December 1989.

Interview between HC&E Internal Change Consultant and author, San Mateo, CA and the author, 16 October 1992.

Kotter, John P., and Schlesinger, Leonard A., "Choosing Strategies for Change," handout from Frank Barrett's Naval Postgraduate School "Managing Change" course.

Kanter, Rosabeth Moss, "Managing the Human Side of Change," *Managing Change - The Human Dimension*, Goodmeasure, Inc., 1984.

Lawrence, Paul R., "Resistance to Change," Excerpt from *Harvard Business Review* article "How to Deal with Resistance to Change," May-June 1954.

Lin, C.H. Michael, "System for Charging Computer Services," *Journal of Systems Management*, v.34, n.11, pp. 6-10, November 1983.

McKinnon, William P., and Kallman, Ernest A., "Mapping Chargeback Systems to Organizational Environments," *MIS Quarterly*, pp. 5-19, March 1987.

Nolan, R., "Managing the Crisis in Data Processing," *Harvard Business Review*, v.57, n.2, pp.115-126, March/April 1979.

ODR, The Implementation Experts, 2900 Chamblee-Tucker Road, Building 16, Atlanta, GA 30341, (404) 455-7145.

Potter, William A., *An Analysis of the Navy Regional Automation Center (NARDAC) Chargeback System*, Master's Thesis, Naval Postgraduate School, Monterey, California, September 1986.

Sanders, Jan, "It Helps Users Understand," *Infosystems*, v.33, n.12, pp.42-45, December 1986.

Schechinger, Terry D., and Prack, Arthur E., *An Analysis of the Computer System Chargeback Concept in the Naval Industrial Fund Environment*, Master's Thesis, Naval Postgraduate School, Monterey, California, June 1983.

Seiden, Neil E., *The DOD Unit Cost Initiative: A Navy Overview, Economic Analysis, and Review of Base Operations Support Cost Allocation*, Master's Thesis, Naval Postgraduate School, Monterey, California, December 1991.

T&M Information Technology Whitepaper, HC&E, San Mateo, CA, March 1992.

Telephone Conversation between HC&E Corporate Network Services Manager and author, San Mateo, CA and the author, 22 December 1992.

Telephone Conversation between HC&E Corporate Information Service Comptroller and author, HC&E, San Mateo, CA and the author, 22 December 1992.

Telephone Conversation between HC&E Corporate Information Service Comptroller and author, San Mateo, CA and the author, 12 January 1993.

Telephone Conversation between HC&E Corporate Information Service Comptroller and author, San Mateo, CA and the author, 29 January 1993.

Telephone Conversation between HC&E Corporate Information Service Comptroller and author, San Mateo, CA and the author 17 February 1993.

Telephone Conversation between HC&E Internal Change Consultant and author, San Mateo, CA and the author 24 February 1993.

Telephone Conversation between HC&E Internal Change Consultant and author, San Mateo, CA and the author 11 March 1993.

Telephone Conversation between HC&E Corporate Information Service Comptroller and author, San Mateo, CA and the author 15 Sep 1993.

The HC&E Way, HC&E, San Mateo, CA, undated.

Thompson, James, *Organizations in Action*, McGraw-Hill, 1967.

BIBLIOGRAPHY

Alley, R.L., and Willits, S.D., "Capacity Based Pricing Offers Viable Chargeback Alternatives," *Data Management*, v.23, n.11, pp.22-28, November 1985.

Anthony, Robert N., *The Management Control Function*, Harvard Business School Press, 1988.

Bernard, Dan, and others, *Charging for Computer Services: Principles and Guidelines*, p.2, Petrocelli, 1977.

Birnberg, Jacob G., and Hufnagel, Ellen M., "Perceived Chargeback System Fairness in Decentralized Organizations: An Examination of the Issues," *MIS Quarterly*, pp. 414-429, December 1989.

Butler, Janet, "Does Chargeback Show Where the Buck Stops?", *Software Magazine*, v.12, n.5, pp. 48-55, April 1992.

DiMaggio, Kathryn A., *Pricing as a Demand Management Tool for Record Communications*, Master's Thesis, Naval Postgraduate School, Monterey, California, March 1989.

DiNardo, George, "Outsourcing Works - With the Right Business Plan: Successful Sellouts," *Corporate Computing*, v.1, n.4, pp. 169-172, November 1992.

Drury, D.H., "Conditions Affecting Chargeback Effectiveness," *Information and Management*, v.5, n.1, pp.31-36, March 1982.

Eager, William, "It Costs What? Information System Chargeback Systems to Quell Complaints," *Corporate Computing*, v.1, n.5, p. 43, November 1992.

Eccles, Robert G., *The Transfer Pricing Problem*, D.C. Heath and Company, 1985.

Endoso, Joyce, "Pentagon Plans to Move IT Systems Oversight to DISA," *Government Computer News*, v.11, n.17, August 17, 1992.

Gates, William R., and Terasawa, Katsuaki L., *Implementing Unit Costing: Efficiency in Translating Policy to Practice*, Working Paper, Naval Postgraduate School, Monterey California, 1993.

Heyne, Paul, *The Economic Way of Thinking*, MacMillan, Inc., 1991.

Hill, Sandra M., "Data Processing Chargeback", *Armed Forces Comptroller*, v.24, n.2, pp.12-14, May 1979.

Hufnagel, Ellen M., and Birnberg, Jacob G., "Perceived Chargeback System Fairness in Decentralized Organizations: An Examination of the Issues," *MIS Quarterly*, pp. 414-429, December 1989.

HC&E Business Overview, (Slide Presentation given by HC&E Network Services Manager), November 1989.

Information Systems Organization Plan, (Slide Presentation), HC&E, March 1991.

Lin, C.H. Michael, "System for Charging Computer Services," *Journal of Systems Management*, v.34, n.11, pp. 6-10, November 1983.

McKinnon, William P., and Kallman, Ernest A., "Mapping Chargeback Systems to Organizational Environments," *MIS Quarterly*, pp. 5-19, March 1987.

Nolan, R., "Managing the Crisis in Data Processing," *Harvard Business Review*, v.57, n.2, pp.115-126, March/April 1979.

Norris, Daniel M., "Segment Reporting for the DP Profit Center," *Journal of Systems Management*, v.34, n.8, pp.42-43, August 1983.

Potter, William A., *An Analysis of the Navy Regional Automation Center (NARDAC) Chargeback System*, Master's Thesis, Naval Postgraduate School, Monterey, California, September 1986.

Seiden, Neil E., *The DOD Unit Cost Initiative: A Navy Overview, Economic Analysis, and Review of Base Operations Support Cost Allocation*, Master's Thesis, Naval Postgraduate School, Monterey, California, December 1991.

Solomon, Lanny and Tsay, Jeffrey, "Pricing of Computer Services: A Survey of Industry Practices," *Cost and Management*, v.59, n.2, pp.5-9, March/April 1985.

Sanders, Jan, "It Helps Users Understand," *Infosystems*, v.33, n.12, pp.42-45, December 1986.

Schechinger, Terry D., and Prack, Arthur E., *An Analysis of the Computer System Chargeback Concept in the Naval Industrial Fund Environment*, Master's Thesis, Naval Postgraduate School, Monterey, California, June 1983.

T&M Information Technology Whitepaper, HC&E San Mateo, CA, March 1992.

Tichy, Noel M., *Managing Strategic Change*, John Wiley & Sons, Inc., 1983.

The HC&E Way, Hypothetical Computers and Electronics, San Mateo, CA, undated.

Thompson, James, *Organizations in Action*, McGraw-Hill, 1967.

Walsh, Myles E., "What is a Data Center", *Journal of Systems Management*, v.35, n.1, pp.20-29, January 1984.

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